

REMARKS

This is intended as a supplemental response to Office Action dated July 29, 2003, and is submitted in response to the Notice of Non-Compliant Amendment dated December 5, 2003. The Notice of Non-Compliant Amendment dated December 5, 2003 indicated that a complete listing of all of the claims was not present and that claims 19-25 were not listed in Applicants' Response to Office Action dated July 29, 2003. Applicants have amended the listing of the claims to show the status of claims 19-25 (cancelled). Applicants have also amended the listing of the claims to revise the status of claims 10-12, 27, 29, 30, and 31 from "original" to "previously presented." Applicants respectfully submit that this supplemental response includes a complete listing of all of the claims and the status of each claim. Claims 1-33 are shown above. Among them, Claims 1-18, 26-31, and 33 remain pending in the application and are shown above. Claims 19-25 were cancelled without prejudice in a Response to Office Action filed on November 27, 2002. Claim 32 was cancelled without prejudice in a Request for Continued Examination (RCE) filed on June 19, 2003, requesting the consideration of the amendment filed on March 10, 2003. Applicants reserves the right to pursue the subject matters of claims 19-25 and 32 in divisional, continuation, or continuation-in-part applications at a later date.

Claims 1-18, 26-31 and 33 remain pending in the application and stand rejected. Please reconsider the claims pending in the application for reasons discussed below. The arguments presented below were presented in Applicants' Response to Office Action filed on October 29, 2003.

The Examiner states that the oath or declaration is defective. A new oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date was submitted with Applicants' Response to Office Action filed on October 29, 2003. Applicants have attached a copy of the declaration that was submitted with Applicants' Response to Office Action filed on October 29, 2003. Withdrawal of the objection is respectfully requested.

35 U.S.C. §103 Rejections

Claims 1-3, 8, 12-14, 16, 26, 27 and 33 are not obvious over Small in view of Svirchevski et al. under 35 U.S.C. §103(a)

Claims 1-3, 8, 12-14, 16, 26, 27 and 33 stand rejected under 35 USC § 103(a) as being obvious over United States Patent No. 5,981,454 to Small and United States Patent No. 6,352,595 to Svirchevski et al. The Examiner states that Small discloses a method of cleaning a wafer using a polishing pad and applying a cleaning composition that has an amine concentration including at least one endpoint of the claimed range, from the wafer to the polishing pad surface. The Examiner also states that the explicitly disclosed range of the amine is 3-20%; however, Figure 3 appears to contemplate a range of activity below 3% and Small further discloses an acid or base such that the composition has a pH of between 3.5 and 7, which anticipates the range of about 5.0 to about 12.0. The Examiner also states Svirchevski discloses a method of cleaning a chemical mechanical polishing (CMP) pad by applying chemicals to the surface of the CMP pad and thereafter rinsing the pad. The Examiner asserts that Small provides the motivation for making the instant combination.

Applicant respectfully traverses the rejection. Small et al. discloses a method of cleaning a wafer with a post clean treatment composition to rinse and remove chemical residues from a wafer having metal or dielectric surfaces after a wet chemistry step, such as post etch residue cleaning step. (See, column 1, lines 29-37 and 45-52.) The post clean treatment composition of Small et al. is for cleaning a wafer by rinsing the wafer in a bath or a beaker (container) containing the post clean treatment solution (PCT), e.g., step 22 in Figure 2. The immersion duration disclosed in Small is from 30 min (Example 2) to 24 hours (Example 3). The rinsing step 22 of Small may employ the post clean treatment solution of Small in place of a carbonated water rinse step 16, an isopropyl alcohol rinse step 18, or an N-methyl pyrrolidone rinse step 20, in a typical process sequence after a cleaning step of an ashing step 12 or a wet chemistry step 14 to clean photoresist or etch residues. (See, column 3, lines 40-51, and Figure 2.) Small does not teach, show, or suggest the method of cleaning a polishing pad, as claimed in claims 1, 12, 26, and claims dependent therefrom. Svirchevski et al. discloses a method

of cleaning a polishing pad using a composition of hydrogen chloride (HCl) and water when the wafer surface is copper, or ammonium hydroxide (NH₄OH) and water, when the wafer surface is oxide. Svirchevski et al. does not teach, show, or suggest the composition as claimed in claims 1, 12, 26, and claims dependent therefrom.

With regard to the Examiner's comments on the disclosed amine range of Figure 3 in Small, Applicants respectfully point out that the cited Figure 3 of Small is not directed to the post clean treatment composition of Small as the Examiner stated, but rather a testing of corrosion rate of aluminum (Al) metal, on a wafer surface as a function of amine concentrations (from 0% to 100%) when rinsing the post clean wafer with a water solution containing 0% to about 100% of amine. Thus, Figure 3 is to demonstrate the problem of using just amine as rinsing agent and "clearly shows that very small quantities of amines will be very corrosive to the metal". (See, column 3, lines 53-60, column 4, lines 7-10, and Figure 3.)

In addition, the Examiner has erred in stating that explicitly disclosed range of the amine is 3-20%. Applicants respectfully point out that the cited 3-20% of amine concentration in water is not directed to the post clean treatment composition of Small as the Examiner stated, but rather a statement of the background problem that need to be solved by Small's post clean treatment solution so as to rapidly neutralize amine and prevent corrosion of metal structure and other features on a wafer. (See, column 3, lines 54-62.) Thus, Small does not teach, show, or suggest the method and composition as claimed.

Therefore, Applicants respectfully disagree with the Examiner and point out that Small et al. does not teach, show, or suggest a method of cleaning a polishing pad surface comprising applying to the polishing pad surface a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water, as recited in claims 1, 12, 26, and claims dependent therefrom.

In addition, Small discloses that the post clean treatment composition can also be used in a chemical mechanical planarization (CMP) process after a final cleaning step (post CMP clean), such as a brush scrub and a rinse, to further rinse and clean a

wafer in the absence of a polishing pad, or directly at a polishing step of silicon oxide CMP or metal CMP by applying the post clean treatment composition on a wafer to polish the wafer in the presence of a polishing pad. (See, column 4, lines 35-44, column 5, lines 15-17, column 6, lines 1-7 and lines 38-41.) Small further discloses that “copper films present a difficult problem because it is a soft metal and is easily damaged by the slurry particles”.

Thus, Small's post clean treatment composition is for rinsing the wafer in the absence of a polishing pad or polishing a copper surface of a wafer in the presence of a polishing pad. Applicants respectfully disagree with the Examiner and point out that Small provide no motivation to combine the teachings and does not teach, show, suggest, or motivate applying Small's post clean treatment composition for cleaning a polishing pad. Therefore, Applicants respectfully point out that Small does not teach, show, or suggest subsequent to chemical mechanical polishing (CMP) a wafer surface containing copper (Cu) or a Cu-based alloy, a method of cleaning a polishing pad surface including applying a cleaning composition to the polishing pad surface, as recited in claims 1, 12, 26, and claims dependent therefrom.

Further, with regard to the pH range, the acidic pH range of about 3.5 to 7 of Small's post clean treatment composition is provided to neutralize the pH of a wafer until the pH reaches 7 and prevent corrosion of metal structure on a wafer during rinsing. Small does not teach, show, or suggest a cleaning composition at both acidic and basic pH range of about 5.0 to about 12.0 for a polishing pad surface, as recited in claims 1, 12, 26, and claims dependent therefrom. Small teaches a composition for different processes than claimed, i.e., rinsing a wafer or polishing a wafer using Small's post clean treatment composition, rather than cleaning a polishing pad surface that has been used and left with copper residues after CMP. Due to the obvious different materials of a wafer and a polishing pad and the complexity of chemistry involved in various different processes, e.g., post etch wafer cleaning, wafer polishing by CMP, post CMP wafer cleaning, as compared to the claimed post CMP and between CMP pad cleaning, comparing the pH range of one composition suitable for a first material in a first process with the pH range of another composition to be used for a second material in a second process is not appropriate. Therefore, the references, alone or in combination, do not

teach, show, or suggest the method and composition, as recited in claim 1, 12, 26, and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

Claims 12-14 and 16 are not obvious over Small in view of Svirchevski et al. under 35 U.S.C. §103(a)

Claims 12-14 and 16 stand rejected under 35 USC § 103(a) as being obvious over Small as set forth above and United States Patent No. 6,352,595 to Svirchevski et al. The Examiner states that the composition is disclosed in Small and what is not explicitly disclosed is the cleaning of the pad between polishing a first wafer and second wafer. The Examiner also states that Small explicitly provides the motivation for making the instant combination and Svirchevski et al. discloses a method of cleaning a chemical mechanical polishing (CMP) pad that has already been used for performing a CMP operation on a wafer surface. The Examiner states that the chemical disclosed in Small is disclosed to be useful because it eliminates the need for flammable solvents, lowers transition metal ion concentrations, and has a high neutralization capacity, and the rationale for cleaning between a first and second wafer would include minimization of contamination build-up and minimization of subsequent bath contamination.

Applicant respectfully traverses the rejection. Small and Svirchevski et al. have been discussed above. Small does not teach, show, or suggest the claimed composition in the claimed range for the claimed method and nowhere does Small provide motivation to use Small's composition for cleaning a polishing pad between polishing a first and a second wafer. The advantage of Small's post clean treatment composition as a rinsing composition for a wafer as stated by the Examiner and disclosed in Small does not provide motivation or rationale for cleaning a polishing pad between polishing a first and a second wafers. Withdrawal of the rejection is respectfully requested.

Claims 4-7, 9-11, and 28-31 are not obvious over Small in view of Kennedy et al. under 35 U.S.C. §103(a)

Claims 4-7, 9-11, and 28-31 stand rejected under 35 USC § 103(a) as being obvious over Small and United States Patent No. 6,280,299 to Kennedy et al. The Examiner states that Small apparently fails to explicitly disclose applying the solution to

a rotating polishing pad at a flow rate of about 10 to 600 ml/min, and Kennedy et al. discloses using a flowrate between 230 and 6000 ml/min. The Examiner also states that an artisan would have been motivated by Kennedy et al. to optimize pad cleaning flowrates and pressures for performing the same task, in the same way, and for the same reason, and the duration of the flow would be a matter of routine optimization. The Examiner also point out that with specific respect to claims 4 and 28 disclosing a pH range of "about 8 to about 11", the taught value of "about 7" seemingly would read on "about 8", while these values may not be contextually taught with identical values. Applicant respectfully traverses the rejection.

Applicant respectfully traverses the rejection. Small is discussed above. Small does not teach, show, or suggest the method and composition as claimed. In addition to the above discussion of pH range of Small's post clean treatment composition, Applicants respectfully point out that a pH range of about 8 to about 11 is basic and pH about 7 is neutral and does not suggest basic pH range.

Kennedy et al. discloses methods and apparatus of cleaning a polishing pad surface or a substrate surface. Kennedy et al. does not teach, show, or suggest the composition as claimed in claims 1, 12, 26, and claims dependent therefrom. As discussed above, there is no motivation existed in either references to combine Small's wafer cleaning composition with Kennedy et al. polishing pad cleaning method.

Further, Small's composition works by rinsing a wafer in a bath such as immersing the wafer for a duration of 30 min (Example 2) to 24 hours (Example 3) rather than for cleaning a polishing pad surface for a short time period after CMP. Thus, Small does not teach, show, or suggest applying a solution to a polishing pad for about 3 seconds to about 20 seconds after conducting CMP as recited in claims 7, 18, and 30, and can not be served as basis for the Small composition to be combined with Kennedy et al.

Therefore, the references, alone or in combination, do not teach, show, or suggest the method as recited in claims 4-7, 9-11, and 28-31. Withdrawal of the rejection is respectfully requested.

Claims 15, 17, and 18 are not obvious over Small in view of Svirchevski et al. and Kennedy et al. under 35 U.S.C. §103(a)

Claims 15, 17, and 18 stand rejected under 35 U.S.C. 103(a) as being obvious over Small, Svirchevski et al. and Kennedy et al. as set forth above. The Examiner states that Small and Svirchevski apparently fail to explicitly disclose applying the solution to a rotating polishing pad at a flow rate of about 10 to 600 ml/min, and Kennedy et al. discloses using a flowrate of between 230 and 6000 ml/min. The Examiner also point out that with specific respect to claim 15, if it is asserted that there are real material differences observed between a pH of 7 and a pH of 8, seemingly such evidence would overcome the obvious rejection. But note that pH values of greater than 10 (and therefore including 11) are disclosed in Small. Applicant respectfully traverses the rejection.

Applicant respectfully traverses the rejection. Small, Svirchevski et al., and Kennedy et al. have been discussed above. Small does not teach, show, or suggest the method and composition as claimed and Svirchevski et al. and Kennedy et al. do not teach, show, or suggest the composition as claimed. As discussed above, there is no motivation in the references to combine Small's wafer cleaning composition with Svirchevski et al. and Kennedy et al.'s polishing pad cleaning method despite the disclosure of flow rates in the method of Svirchevski et al. and Kennedy et al.

Further, Small's composition works by rinsing a wafer in a bath such as immersing the wafer for a duration of 30 min (Example 2) to 24 hours (Example 3) rather than for cleaning a polishing pad surface for a short time period after CMP. Thus, Small does not teach, show, or suggest applying Small's post clean treatment solution to a polishing pad for about 3 seconds to about 20 seconds after conducting CMP as recited in claims 7, 18, and 30, and can not be served as basis for the Small composition to be combined with Svirchevski et al. and Kennedy et al.

Therefore, the references, alone or in combination, do not teach, show, or suggest the method as recited in claims 4-7, 9-11, and 28-31. Withdrawal of the rejection is respectfully requested.

In conclusion, the references cited by the Examiner, alone or in combination, do not teach, show, or suggest the invention as claimed.

Having addressed all issues set out in the office action, Applicants respectfully submit that the claims are in condition for allowance and respectfully request that the claims be allowed. Applicants respectfully request entry of this supplemental response.

Respectfully submitted,


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